DURGA VALVES

DVPL

MULTI-DOOR NRV

www.dvpl.co.in

DVPL stands at the forefront of Fluid Management Technology, a position earned through years of expertise and in-depth knowledge. The company is dedicated to creating advanced, innovative solutions for Water Management Systems, which have been successfully implemented in a wide range of projects, both large and small. This commitment to excellence allows DVPL to address complex water challenges with precision and efficiency.

Every day, the impact of DVPL's work is felt as its valves play a crucial role in providing clean, safe water to millions of people across India. These moments of service, however small they may seem, represent a larger vision of improving lives and contributing to the nation's well-being.

As a company, DVPL takes immense pride in supporting the Make-in-India initiative. By manufacturing high-quality, locally-made products, DVPL not only strengthens the country's industrial capabilities but also fosters innovation that resonates globally.

CI | CS | DI | SS | FAB

What is a Multi-Door NRV (Non-Return Valve) and Why is it Used?

A Multi-Door Non-Return Valve (NRV) is a type of check valve designed with multiple hinged doors (or flaps) that open in the direction of fluid flow and close automatically when the flow stops or reverses. This prevents backflow, making it essential for water and fluid transport systems.

Material and Design Availability:

- Available in Various Materials:
  - Cast Iron (CI), Ductile Iron (SG), and Carbon Steel (WC-B), Stainless Steel (CF8 and CF8M) to suit different water supply, industrial and municipal applications.
- Pressure Ratings:
  - PN 1.0, PN 1.6, PN 2, PN 2.5, CL-150, and CL-300, covering a wide range of operational pressures.
  - Sizes from 600 mm to 2500 mm
- Seating Options:
  - Metal-to-Metal for high-temperature and heavy-duty applications.
  - Metal-to-Rubber for better sealing, preventing leakage, and reducing noise.

Applications of Multi-Door NRVs:

- Water Supply Networks (Municipal and Industrial)
- Irrigation Systems, Lift Pumping Stations and Rising Mains
- Power Generation Projects
- Water, Wastewater Treatment Plants

MULTI-DOOR NRV

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Durga Valves Pvt. Ltd.'s Multi-Door Non-Return Valves (NRVs) exemplify superior engineering and are designed for optimal performance in water works applications. These valves generally conform to IS 5312: Part 2: which specifies the requirements for swing check type reflux (non-return) valves of a multi-door pattern used in waterworks.

Key Features of Durga Multi-Door NRVs:

- Ensures adherence to established dimensions, materials, and construction standards, guaranteeing reliability and compatibility in water works systems.
- Precision Engineering: Doors are hinged on a diaphragm, with door rings and diaphragm rings meticulously machined, ground, and lapped to achieve zero leak tightness, enhancing operational efficiency.
- Size-Specific Door Configuration: The number of doors varies with valve size—two doors to four doors ensuring optimal flow control across different applications.
- By-Pass Arrangement: Available upon customer request, In summary, Durga's Multi-Door NRVs are meticulously crafted to meet stringent standards, offering robust construction, precise operation, and customizable features.

Technical Aspects of Multi-Door NRVs

1. Head Loss Reduction:
   - Multi-door NRVs are designed to minimize head loss compared to single-door check valves.
   - The smaller individual doors allow for distributed flow paths, reducing overall flow resistance and pressure drop.
   - Computational Fluid Dynamics (CFD) studies have shown that multi-door designs can reduce head loss by up to 30% compared to traditional single-door NRVs.
2. Lower Flow Resistance & Energy Efficiency:
   - The segmented flow paths reduce turbulence, ensuring a more streamlined and energy-efficient operation.
   - Lower resistance means less energy consumption in pumping applications, leading to reduced operational costs.
3. Effect of Water Hammer Mitigation:
   - Water hammer occurs when a sudden valve closure creates a pressure surge, potentially damaging pipelines, and pumps.
   - The rounded, curved body design of multi-door NRVs helps distribute internal stresses more uniformly during transient conditions, such as water hammer events. This geometry reduces localized pressure peaks and effectively dampens shock loads, resulting in enhanced durability and protection of internal components
   - The smaller doors, hinged on individual axes, reduce the impact force during closure, preventing extreme pressure fluctuations.

Additional Features of Multi-Door NRVs

Inspection Door: Multi-Door NRVs come equipped with an inspection door, allowing easy access for maintenance and internal inspection without needing complete valve disassembly. This feature improves serviceability and reduces downtime in critical applications.

Performance Comparison: Multi-Door NRV vs. Other Check Valve Types

Parameter	Multi-Door NRV	Single-Door Swing Check Valve	Dual Plate Check Valve	Tilting Disc Check Valve	Lift Check Valve
Head Loss	**Low** – Multi-door design reduces resistance, lowering head loss.	Moderate – Single flap creates more resistance.	**Low** – Compact plates allow smooth flow.	**Low** – Disc tilts with minimal obstruction.	**High** – Flow is restricted through a guided lift mechanism.
Flow Resistance	**Low** – Smaller doors distribute flow evenly.	Moderate – Large single flap creates obstruction.	Moderate – Dual plates open parallel to flow.	**Low** – Tilting mechanism ensures smooth flow.	High – Flow must push the disc vertically.
Turbulence Control	**Good** – Multiple doors minimize eddies and vortex formation.	Moderate – Single flap creates sudden flow obstruction.	**Excellent** – Plates open and close with minimal disturbance.	**Good** – Disc tilts smoothly without major flow interruption.	Moderate – Flow disruption is controlled but present.
Installation Space	**Large** Requires flanged connections and adequate clearance.	**Large** – Single flap requires space to swing open.	**Compact** – Requires minimal space due to thin profile.	**Moderate** – Slightly more space than dual plate valves.	**Large** – Needs sufficient vertical clearance.
Best Used For	Large pipelines, high-flow systems, and water distribution networks.	Standard water supply systems with moderate pressure.	HVAC, power plants, and industrial applications needing low head loss.	Pumping stations, oil & gas, and industrial pipelines.	High-pressure steam and gas applications.

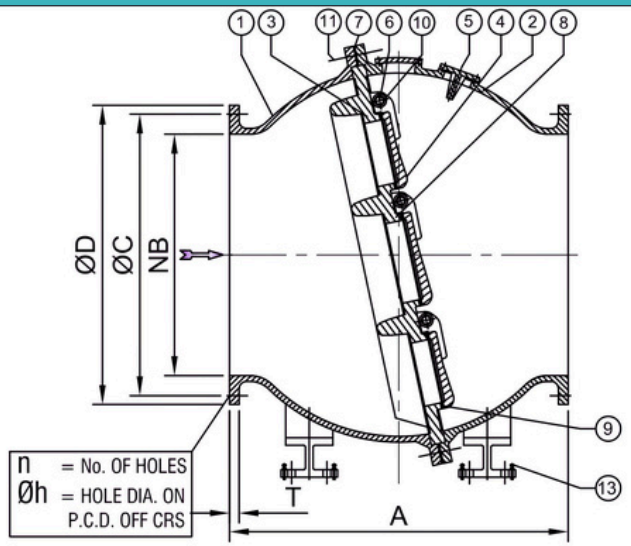
Superior Flow Capacity of Multi-Door NRVs

Multi-Door Non-Return Valves (NRVs) offer significantly better flow capacity compared to traditional single-door swing check valves. Their unique multi-door design minimizes flow resistance, allowing fluid to pass through with reduced turbulence and lower pressure drop. Unlike single-door valves, where a large disc obstructs a significant portion of the flow path, multi-door NRVs distribute the backflow prevention mechanism across multiple smaller doors. This segmented flow distribution reduces velocity disruptions, prevents sudden pressure fluctuations, and enhances overall efficiency.

Real-World Applications & Data

1. Water Distribution Networks: In large-diameter municipal water pipelines (e.g., 600mm and above), Multi-Door NRVs exhibit a 30-40% lower head loss than single-door check valves, ensuring higher efficiency and energy savings.
2. Pumping Stations: In high-flow industrial applications, such as irrigation and wastewater treatment plants, Multi-Door NRVs allow 10-20% more flow for the same pressure drop, reducing pumping energy costs.
3. Cooling Water Systems: In power plants and HVAC cooling circuits, their fast-closing mechanism minimizes reverse flow, protecting pumps from cavitation and reducing the risk of pressure surges.
4. Hydroelectric & Dams: Used in penstock applications, where handling large volumes with minimal resistance is critical.

4. Flow Turbulence Control:
    - Unlike single-flap NRVs, which create a sudden barrier to flow upon closing, multi-door NRVs allow for a gradual reduction of flow velocity, preventing backflow-induced turbulence.
    - The multiple doors reduce eddies and vortex formation, maintaining stable and smooth fluid flow.
    - This feature is especially crucial in large-diameter pipelines, where turbulence can cause excessive vibration and wear on the valve body.



SECTIONAL ELEVATION (SEC- AA)

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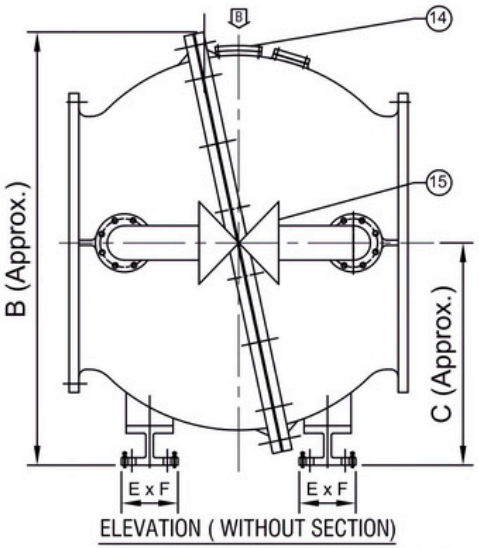
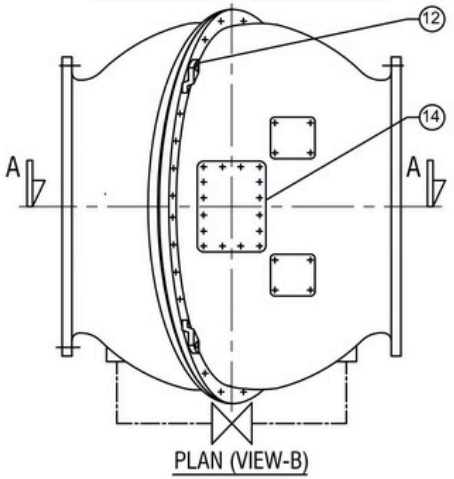


ELEVATION (WITHOUT SECTION)



PLAN (VIEW-B)

MATERIALS OF CONSTRUCTION

SL. No.	DESCRIPTION	MATERIALS & SPECN.	
1.	BODY (INLET)	CAST IRON	IS:210 Gr. FG-200
2.	BODY (OUTLET)		
3.	DIAPHRAGM	CAST STEEL	ASTM A216 Gr.WCB
4.	DOOR WITH HINGE		
5.	STOPPER		
6.	HINGE PIN / DOOR PIN	STAINLESS STEEL	ASTM A276 TYPE-410
7.	GASKET	RUBBER	IS:638 TYPE-B
8.	BODY / DIAPHRAGM SEAT	L.T BRONZE	IS : 318 Gr. LTB-2
9.	DOOR FACE SEAT		
10.	BUSHES		
11.	BOLTS/STUDS & NUTS	CARBON STEEL	IS:1367 CL-4.6 & 4.0
12.	LIFTING HOOK	FORGED STEEL	-
13.	JACKING SCREW	HIGH TENSILE STEEL	-
14.	INSPECTION HOLE COVER	CAST IRON	IS:210 Gr. FG-200
15.	BY-PASS ARRANGEMENT	DI 150 NB NON RISING STEM SLUICE VALVE (IS:14846)	

HYDROSTATIC TEST PRESSURE FOR PN-10

BODY TEST PRESSURE :- 15 Kg./Cm²(g) WITH WATER DURATION 5 MIN.
SEAT TEST PRESSURE :- 10 Kg./Cm²(g) WITH WATER DURATION 2 MIN.

NOTES

1. ALL DIMENSIONS ARE IN MM. UNLESS OTHERWISE STATED.
2. THE SWING CHECK TYPE (MULTI-DOOR) NON RETURN VALVE AS PER IS:5312 (Part-2)
3. FLANGED ENDS SHALL BE FLAT FACED & DRILLED TO IS:1538 (Tab- 4 & 6).
4. THE ARROW MARK SHALL BE CAST INTEGRALLY ON THE BODY TO INDICATE THE DIRECTION OF FLOW.
5. THE VALVES SHALL BE SUITABLE FOR MOUNTING ON HORIZONTAL PIPE LINE.
6. PAINTING:- ALL VALVES SHALL BE PAINTED WITH BLACK BITUMINOUS PAINT
7. MARKING : BRAND NAME / SIZE / RATING / HEAT NO. / SL. NO., FLOW DIRECTION,

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MULTI-DOOR NRV

CAST IRON

REFERENCE GAD

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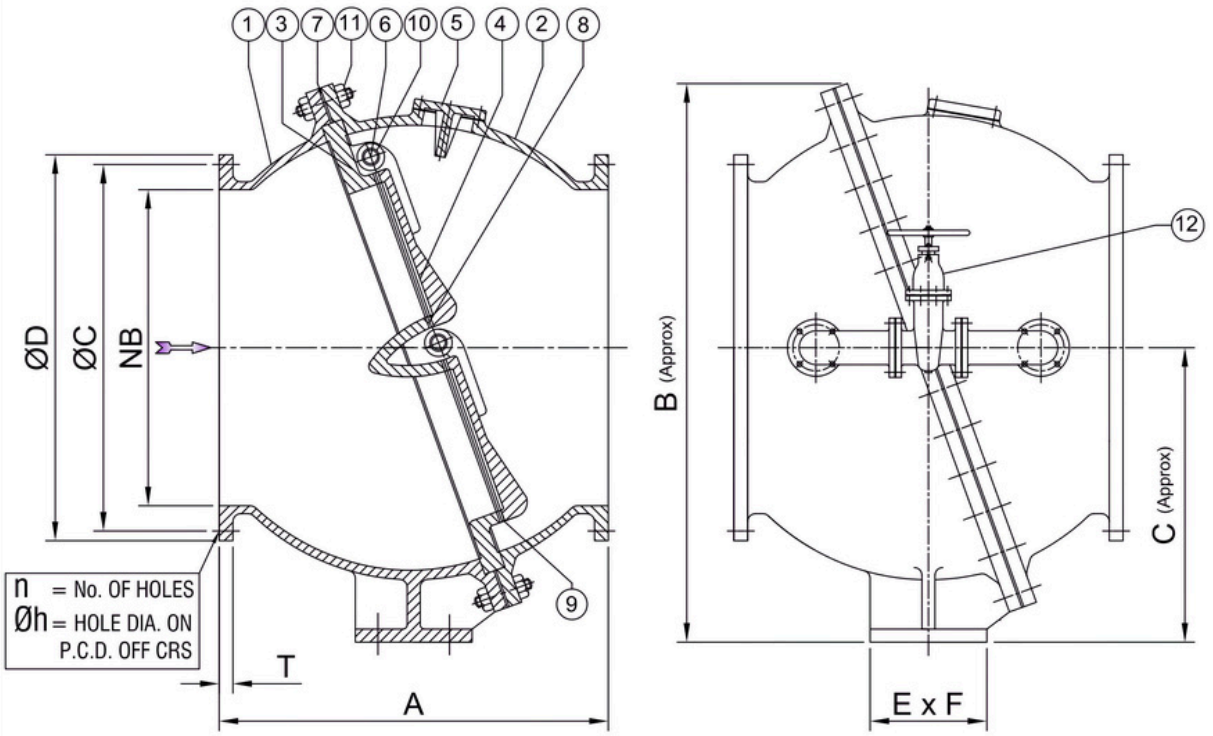
APPROVAL STAMP



MATERIALS OF CONSTRUCTION

SL. No.	DESCRIPTION	MATERIALS & SPECN.	
1.	BODY (INLET)	CAST STEEL	ASTM A216 Gr. WCB
2.	BODY (OUTLET)		
3.	DIAPHRAGM		
4.	DOOR (04 Nos.)		
5.	STOPPER		
6.	HINGE PIN / DOOR PIN	STAINLESS STEEL	ASTM A276 Type-410
7.	GASKET	RUBBER	IS:638 TYPE-B
8.	BODY / DIAPHRAGM SEAT	L.T. BRONZE	IS:318, LTB-2
9.	DOOR FACE SEAT		
10.	BUSHES		
11.	BOLTS/STUDS & NUTS	CARBON STEEL	IS:1367 CL- 4.6 & 4.0
12.	BY-PASS ARRANGEMENT	CS DF SLUICE VALVE (IS:14846) PN-1.6	

HYDROSTATIC TEST PRESSURE FOR PN-1.6

BODY TEST PRESSURE :- 24 Kg./Cm²(g) WITH WATER DURATION 5 MIN.
SEAT TEST PRESSURE :- 16 Kg./Cm²(g) WITH WATER DURATION 2 MIN.

NOTES

1. ALL DIMENSIONS ARE IN MM. UNLESS OTHERWISE STATED.
2. THE SWING CHECK TYPE (MULTI-DOOR) NON RETURN VALVE AS PER IS:5312 (Part-2).
3. FLANGED ENDS SHALL BE FLAT FACED & DRILLED TO IS:1538 (Tab- 4 & 6).
4. THE ARROW MARK SHALL BE CAST INTEGRALLY ON THE BODY TO INDICATE THE DIRECTION OF FLOW.
5. THE VALVES SHALL BE SUITABLE FOR MOUNTING ON HORIZONTAL PIPE LINE.
6. PAINTING :- VALVES WILL BE PAINTED WITH 2 COATS OF RED OXIDE ZINC CHROMATE PRIMER & 2 COATS OF SYNTHETIC ENAMEL AS FINISH PAINT.
7. MARKING : BRAND NAME / SIZE / RATING / HEAT NO. / SL. NO. & FLOW DIRECTION

MULTI-DOOR NRV

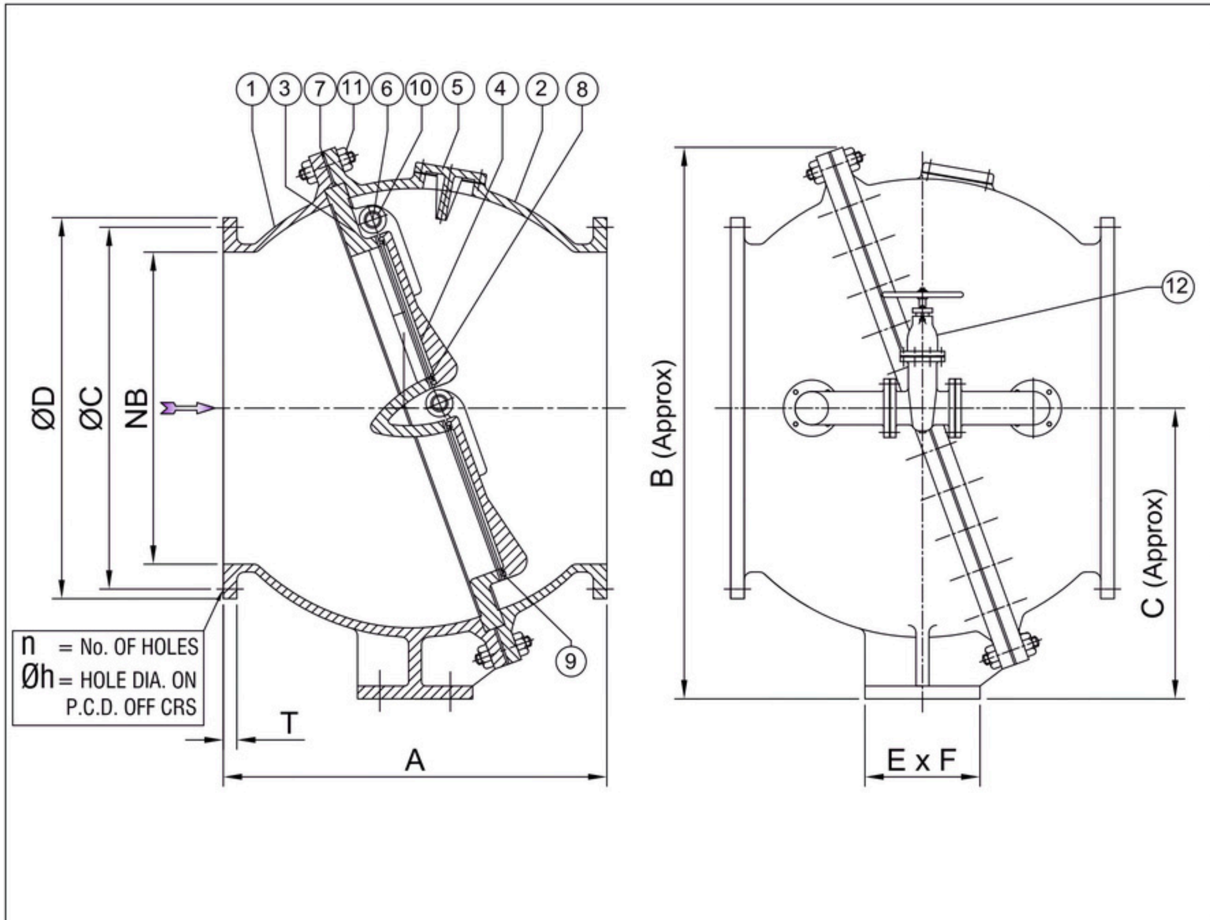
CAST STEEL

REFERENCE GAD

MULTI-DOOR NRV

DUCTILE IRON

REFERENCE GAD



MATERIALS OF CONSTRUCTION

SL. No.	DESCRIPTION	MATERIALS & SPECN.	
1.	BODY (INLET)	DUCTILE CAST IRON	DIN:1693 Gr. GGG-50
2.	BODY (OUTLET)		
3.	DIAPHRAGM	DUCTILE CAST IRON	DIN:1693 Gr. GGG-50
4.	DOOR		
5.	STOPPER	DUCTILE CAST IRON	DIN:1693 Gr. GGG-50
6.	HINGE PIN / DOOR PIN	STAINLESS STEEL	ASTM A276 TYPE-410
7.	GASKET	RUBBER	IS:638 TYPE-B
8.	BODY / DIAPHRAGM SEAT	STAINLESS STEEL	ASTM A351 CF-8
9.	DISC SEAL	EPDM (SHORE HARDNESS 65 ±5)	
10.	BUSHES	L.T. BRONZE	IS:318, LTB-2
11.	BOLTS/STUDS & NUTS	CARBON STEEL	IS:1367 CL- 4.6 & 4.0
12.	BY-PASS ARRANGEMENT	DIDF 100 NB SLUICE VALVE PN-1.6	

HYDROSTATIC TEST PRESSURE FOR PN-1.6

BODY TEST PRESSURE :- 24 Kg./Cm²(g) WITH WATER DURATION 5 MIN.

SEAT TEST PRESSURE :- 16 Kg./Cm²(g) WITH WATER DURATION 2 MIN.

NOTES

1. ALL DIMENSIONS ARE IN MM. UNLESS OTHERWISE STATED.
2. THE SWING CHECK TYPE (MULTI-DOOR) NON RETURN VALVE AS PER IS:5312 (Part-2)
3. FLANGED ENDS SHALL BE FLAT FACED & DRILLED TO IS:1538 (Tab- 4 & 6).
4. THE ARROW MARK SHALL BE CAST INTEGRALLY ON THE BODY TO INDICATE THE DIRECTION OF FLOW.
5. THE VALVES SHALL BE SUITABLE FOR MOUNTING ON HORIZONTAL PIPE LINE.
6. PAINTING:- ALL VALVES SHALL BE PAINTED WITH RAL BLUE LIQUID EPOXY PAINT WITH 200-250 MICRONS BOTH INSIDE & OUTSIDE.
7. MARKING : BRAND NAME / SIZE / RATING / HEAT NO. / SL. NO. & FLOW DIRECTION

Material Selection & Recommended Pressure Ratings Considering Water Hammer Effects

The table below provides a guideline for selecting the appropriate material for Multi-Door NRVs based on the nominal pressure rating (PN/Class) and expected momentary water hammer spike pressures.

Material	Nominal Pressure Rating	Recommended Maximum Pressure (Including Water Hammer Spikes)	Applications
Cast Iron (CI)	PN 1.0 – PN 1.6 (10-16 bar)	Up to **15 TO 20 bar** momentary spike	Low-pressure water supply, municipal systems, Water distribution, irrigation, and fire protection
Ductile Iron (DI)	PN 1.0 – PN 2.5 (10-25 bar)	Up to **35 bar** momentary spike	Water distribution, irrigation, and fire protection
Carbon Steel (CS)	CL-150 (PN 20) – CL-300 (PN 50)	Up to **75 bar** momentary spike	Water distribution, irrigation, and fire protection, Industrial water systems, oil & gas, refineries
Stainless Steel (SS 304/316)	CL-150 (PN 20) – CL-600 (PN 100)	Up to **120 bar** momentary spike	Water distribution, irrigation, and fire protection, Corrosive environments, chemical plants, and desalination

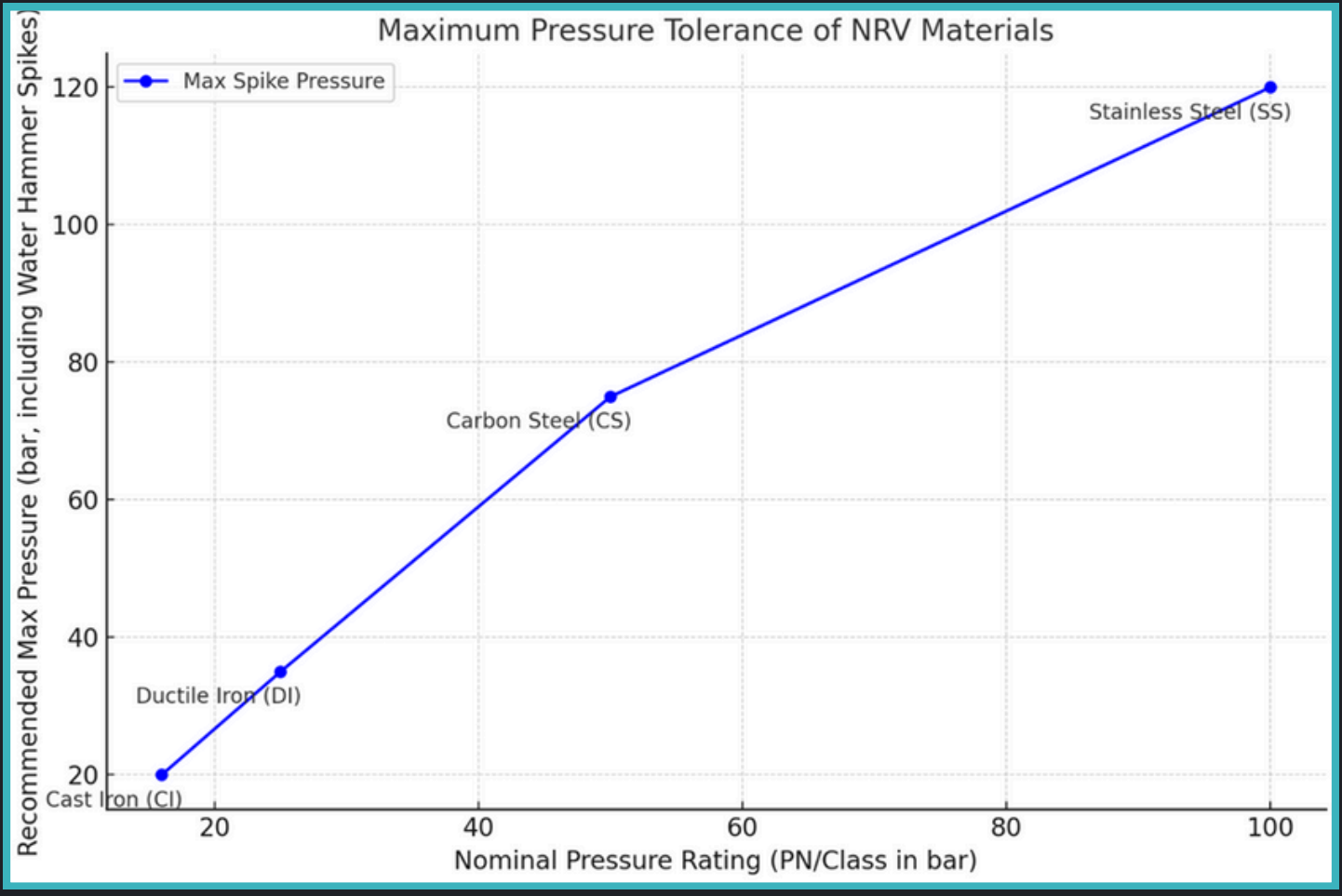
Comparison of CI, DI, CS, and SS Materials

- The table below highlights the key differences between Cast Iron (CI), Ductile Iron (DI), Carbon Steel (CS), and Stainless Steel (SS) based on mechanical properties, durability, and applications.

Property	Cast Iron (CI)	Ductile Iron (DI)	Carbon Steel (CS)	Stainless Steel (SS)
Composition	Fe + C (2-4%) + Si	Fe + C (2-3%) + Mg	Fe + C (0.05-1%) + Mn	Fe + C (≤1.2%) + Cr (10-30%) + Ni
Strength (MPa)	150 - 300	400 - 600	450 - 700	500 - 900
Ductility	Low (Brittle)	High (Flexible)	Moderate to High	High
Toughness	Low	High	High	Very High
Corrosion Resistance	Good	Good to Moderate	Moderate	High (Self-protecting oxide layer)
Wear Resistance	High	Moderate	Moderate	High
Machinability	Good	Moderate	Good	Difficult
Cost	Low	Moderate	Moderate-High	High
Weight	Heavy	Medium	Heavy	Light-Medium
Weldability	Poor	Moderate	High	Moderate
Impact Resistance	Low (Brittle)	High (Absorbs shocks)	High	High
Application	Water, Sewer, Fire, Industrial	Water, Sewer, Industrial, and Fire	Industrial Pipelines, Oil & Gas, High-Pressure Water, Irrigation, Power Generation.	Corrosive Environments, Food Processing, Chemical Plants

Here is the graph showing the maximum pressure tolerance of different NRV materials, including their nominal pressure rating and recommended maximum pressure (including water hammer spikes).

Comparison of CI, DI, CS, and SS Materials



Flow Capacity Formula in Metric Units

The **flow capacity (Q) in metric units** for a valve is typically determined using the **Cv (flow coefficient)** formula, adapted for SI units:

$$Q = Cv \times \sqrt{\frac{\Delta P}{SG}}$$

Where:

- Q = Flow rate (**m^3/h**)
- Cv = Flow coefficient of the valve (**dimensionless**)
- ΔP = Pressure drop across the valve (**bar**)
- SG = Specific gravity of the fluid (dimensionless, for water **SG = 1** at 4°C)

Disclaimer

The recommended maximum pressure ratings, including momentary water hammer spikes, are approximate values based on general industry practices. Actual system conditions, fluid velocity, valve installation, and transient pressure events must be evaluated to ensure the appropriate valve selection. A detailed hydraulic surge analysis should be conducted for pipelines susceptible to severe pressure. The above material comparison is for general reference purposes only. Actual material performance may vary based on manufacturing standards, environmental conditions, specific application requirements, and pressure fluctuations, including water hammer effects. Users should consult industry standards (e.g., IS, ASTM, ASME) and manufacturers' specifications before making a final selection. We do not assume liability for any direct or indirect consequences resulting from the use of this data.

MULTI-DOOR NRV

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